REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 1-8, 18, 19, 25, 29-31, 33-36, and 43-45 are pending in the application subsequent to entry of this Amendment.

As a preliminary matter, counsel again requests that the examiner acknowledge receipt of applicants' claim for foreign priority as well as the relevant and certified copy of the priority document. It is noted that the Notice of Acceptance dated January 25, 2007 indicate that the priority document was received by the USPTO on December 23, 2004. Acknowledgement of receipt of the priority document in the next communication is again requested.

In the interest of expediting prosecution submitted herewith are new independent claims 44 and 45 that the examiner will more easily understand. Claim 44 refers to a "pre-shaped" foam and finds basis in the original description of the invention at page 21, line 22 "The use of a pre-shaped foam ...". Claim 45 is added to recite that the pre-formed energy dispersive material is "manufactured to the substantially final or final shape of the desired helmet shape" and is based upon the description of the invention, in particular page 10, lines 2-4 which reads "The pre-formed energy dispersive material may be manufactured to the substantially final or final shape of the desired helmet shape". *See* also page 9, line 9.

Basis for these new claims will be apparent from the above.

Referring now to the numbered sections of the Office Action:

1-2) In a new rejection, claims 1, 2 and 8 are rejected under 35 USC § 102 (b) as being anticipated by Ross (EP0650333). This is in fact the same document as raised in the first Office Action in connection with obviousness, but then referenced as "Brine et al.". It is respectfully submitted that this rejection is wholly unjustified and based on an incorrect construction of the terminology of claim 1.

In the last Office Action (at the top of page 3), the Examiner correctly recognized that claim 1 requires the use of "an energy dispersive material which is shaped to its desired shape prior to placement in the mold". However, in section 8 of the second Office Action, the Examiner now advises that:

> "However, a careful reading of the claims has changed examiner's opinion as to the scope of the claims and examiner now believes the claims do not require a pre-shaped foam. A preformed foam is simply a foam that is already a layer i.e. is not injected in the mold. By this reading,

> the claims are not commensurate in scope with applicant's argument since they do not require the foam to be pre-shaped to that of a head prior to placement in the mold."

The Examiner's interpretation is incorrect, and hence, all the rejections in the Office Action are unjustified.

According to MPEP § 2173.05(a) I.:- "During patent examination, the pending claims must be given the broadest reasonable interpretation consistent with the specification. *In re Morris*, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); *In re Prater*, 415 F.2d 1393, 162 USPQ 541 (CCPA 1969). When the specification states the meaning that a term in the claim is intended to have, the claim is examined using that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 13 USPQ2d 1320 (Fed. Cir. 1989)."

It is respectfully submitted that it is necessary to interpret the phrase:- "a pre-formed energy dispersive material comprising a preformed foam" with due regard for the specification. Page 7, lines 8 to 13, of the present PCT specification provides the following **explicit interpretation** of the term "preformed":-

> "For the purposes of this specification the term "pre-formed" shall be taken to mean that the energy dispersive material has been substantially shaped as required. Thus the method of the present invention need not shape the energy dispersive material to any great degree, unlike the prior art methods mentioned above. The first and third polymer reinforced fibre layers are shaped and formed during the method of the present invention."

Not only does the specification provide the above clear definition, but the skilled reader upon reading the rest of the specification would, in any case, clearly understand that the entire phrase "a pre-formed energy dispersive material comprising a pre-formed foam" could not possibly be construed to cover a layer of foam, as taught by Ross.

As explained in Applicant's last response, Ross (EP 0650333) is explicitly acknowledged in the present specification as follows:

> "However, there still remain a number of technical problems in producing sandwich core helmets using mass production techniques, especially if a high dimensional tolerance is also required. EP Patent 0650333 details the use of a sandwich type structure where an outer layer, which is comprised of either a resin and fabric or a pre-impregnated

> fabric, is placed in a female mould and pressed into place by hand. Afterwards the resilient layer and inner layer are loaded into the mould with hand pressing at each stage. The resilient material is defined as a flat sheet of either honeycomb, foam or cork. The problem with this method is that it requires each individual layer to be pressed by hand at each stage to ensure that it conforms correctly to the female mould, which is a time consuming process. A further problem arises when you press the flat sheet of foam under final consolidation pressure, as the foam will not conform properly to the mould shape and thus will decrease the dimensional tolerance of the finished helmet. Finally the consolidated helmet has to be finished, such as cutting out the opening for the visor."

Hence, it is clear from the present specification that claim 1 could not possibly have been intended to cover a flat sheet of foam.

Furthermore, upon reading the specification it is entirely clear that the crux of the invention is the use of a pre-shaped core layer of energy dispersive material. There are numerous explanatory references throughout the specification which make it clear that the preformed energy dispersive material could not be construed as merely a flat sheet of foam. The Examiner's attention is directed to the following examples:

- Page 7, line 9:- "the energy dispersive material has been substantially shaped as required"
- Page 7, lines 10-11:- "Thus the method of the present invention need not shape the energy dispersive material to any great degree, unlike the prior art methods mentioned above."
- Page 21-22 :- "the use of a pre-formed energy dispersive material can provide a high level of accuracy and dimensional tolerance"
- Page 8, Lines 3-5:- "the use of a pre-formed energy dispersive material provides a template for the final shape of the inner layer"
- Page 10, lines 2-4:- "The pre-formed energy dispersive material may be manufactured to the substantially final or final shape of the desired helmet shape".
- Page 18, lines 4-5:- "The energy dispersive material will behave as a female mould for the third (inner) layer"

In view of the foregoing, it is submitted that Applicant has provided convincing reasoning why claim 1 necessarily requires the foam to be construed as "pre-shaped". Indeed,

page 21, line 22 actually uses that terminology:- "the use of a pre-shaped foam" as a passing reference.

As previously conceded by the Examiner, Ross does not disclose the use of "an energy dispersive material which is shaped to its desired shape prior to placement in the mold", and hence, the claim 1 phrase "a pre-formed energy dispersive material comprising a pre-formed foam" is not anticipated.

3-4) The Examiner alleges that claims 3-7 are rejected under 35 USC §103 (a) as being unpatentable over Ross (EP0650333).

Claims 3 to 7 are allowable by virtue of their appendence to allowable claim 1; *see* MPEP §2143.03.

However, it is also noted that claims 3 and 5 are each clearly patentable in their own right over Ross. Claim 3 requires the first layer to be bonded to the second layer prior to introduction into the mold. Claim 5 requires the third layer to be bonded to the second layer prior to introduction to the mold. Claim 1 requires the second layer to already be substantially shaped as required. It therefore acts as a template for the first and third layers making lay-up much easier.

By contrast, according to Ross, it would be necessary to squash and fold the second layer during insertion to try to get it into the desired shape. It would make assembly even more difficult, if not impossible, if one were to attempt to stick multiple layers together before insertion in the mold. Ross is teaching the layer by layer lay-up of 2-D layers. It is only the concept of the present invention of using an intermediate, shaped core as a template that it is then possible to contemplate the luxury of sticking the outer layers to the shaped core layer before insertion. Hence claims 3 and 5 are also inventive in their own right, when read in combination with claim 1.

5) Examiner alleges that claims 18, 19, 25 and 43 are rejected under 35 USC §103 (a) as being unpatentable over Ross (EP0650333) as applied to claim 1 above, and further in view of Bothwell et al. (GB1,173,275) and Foreman et al. (Design, Manufacture, and Test of Lightweight Composite Sandwich Helmets).

Claims 18, 19, 25 and 43 are allowable by virtue of their appendance to allowable claim 1.

6) Examiner alleges that claims 29-31 are rejected under 35 USC § 103 (a) as being unpatentable over Ross (EP0650333) as applied to claim 1 above, and further in view of Wilson (US 6,401,258) and Wallace (US 4,972,527).

Rather confusingly, the Examiner appears in this section to again be acknowledging that claim 1 requires "pre-forming at least the energy dispersive layer to the final shape" (as in the first Office Action), since the Examiner in this section is relying on Wilson to teach this feature.

It is submitted that any obviousness rejection based on the combination of Ross and Wilson is unjustified and wholly unrealistic.

Wilson is clearly, without question, non-analogous art that would not have been consulted by one skilled in the art at the time of the invention. Only art that is analogous to a claimed invention may be employed in an obviousness determination.

Firstly, it is not in the field of Applicant's endeavor, namely, the field of polymer composite sandwich (PCS) technology, specifically PCS safety helmets. Instead, it resides in the field of clothing/headwear, specifically, novelty hats! Secondly, it is not a reference "which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem". *In re Clay, 966 F.2d 656, 659 (Fed. Cir. 1992).*

The present invention is concerned with a process for assembling a polymer composite sandwich structure into a safety helmet. Sandwich core technology is discussed from page 5 onwards of the specification. Sandwich structured composites are special classes of composites (i.e. engineered materials) in which two thin but stiff skins surround a lightweight core material to provide an integral structure with a high level of overall stiffness. (*See*, for example, the attached extract with a definition from the online free encyclopedia, Wikipedia, found at: **http://en.wikipedia.org/wiki/Sandwich_structured_composite**.) As specified in claim 1, a polymer material permeates the three layers and hardens so that the three layers act as a single material/structure, a composite.

As explained on page 4 of the specification, a helmet designer wishing to use polymer composite sandwich technology to make a safety helmet (which helmets will be highly specialist and mainly intended for motorsports applications) will need to make sure the helmet is, *inter alia*:

- lightweight with a stiff outer impact shell

- low moment of inertia
- correct center of gravity
- secure fitting
- comfortable but with adequate impact protection

Accordingly, the helmet will need to meet a number of exacting structural performance criteria and dimensional criteria, most of which will be associated with safety.

By contrast, Wilson is concerned with fun headgear for sports fans to wear to sporting events. It describes novelty headgear such as "cheese hats" formed out of a yellow foam material (resembling cheese) worn in support of certain football or athletic teams. It is clear that Wilson is merely describing a type of foam hat intended to be in the shape of a helmet. It should be noted that Wilson is NOT anywhere describing the manufacture of a safety helmet *per se* capable of protecting a head, but rather is teaching the manufacture of joke hats that resemble helmets. (Column 1, line 23 references "novel headgear is provided in a shape resembling a football helmet"; column 1, line 47: "may be supplied to resemble a chin-strap of a football helmet"; column 1, lines 52-54: "A face mask structure may also be added to provide further resemblance to an actual player helmet worn by the athletes".) There are no safety considerations required whatsoever in the design of these novelty hats, rather the considerations are warmth (column 1, line 38) and aesthetic novelty (column 1, line 52).

It should also be understood that Wilson is not concerned in any way with "composite sandwich structures". Wilson describes an assembled structure that may include fabric outer layers, foam rubber layers, and warm liners, merely adhered together by adhesive or assembled by foaming the foam rubber layer in situ to form the article. Such a structure is merely a simple, layered hat and not remotely similar to a composite sandwich structure which is a specialized engineered material (namely, an integrated single structure formed by infusing and hardening a selected matrix material that has been permeated through the entire layered structure).

Thus, Wilson is not concerned with the preparation of a composite sandwich structure. It is not even remotely concerned with the manufacture of safety helmets requiring strength and safety performance criteria. It is merely concerned with novelty hats made from multiple layers. Hence, it would never have been considered by a skilled designer attempting to design a safety

helmet using polymer composite technology and its citation in an obviousness rejection is spurious and wholly unrealistic.

Applicant further submits that this rejection is improper because it is based upon a document selected solely with hindsight. This reference has merely been found by a keyword search using terms such as "helmet", "foam", when in fact it has nothing to do with the provision of a true safety helmet. One has to question how, absent hindsight, the Examiner came to rely upon a reference that relates to "headgear for sports fans", and is clearly in a non-analogous art area.

In view of the foregoing, the cited prior art combination does not teach or suggest the use of a pre-shaped core layer in a PCS safety helmet, and hence, claims 29 to 31, which include the features of claim 1 form which they append, are clearly allowable.

Moreover, concerning claims 29-31, Applicant's previous response noted how claim 29 is directed towards protecting an important and novel and inventive subsidiary technical aspect, namely, the use of at least three interconnecting sections to form the second layer. This allows the present invention, namely the idea of using a pre-formed i.e. pre-shaped foam sandwich core, to be applied to both non re-entrant and re-entrant shaped helmets.

As explained in Applicant's previous response in connection with the non-obviousness of claim 1, at the time of the invention, it was highly innovative to depart from standard sandwich core structures – involving the mere laying up, by manual assembly, of a plurality of 2D (two-dimensional) material layers (as taught by Ross) prior to resin infusion/curing – to think to use a pre-shaped core layer which could act as a template – so that after curing one arrives at one integrated component. In the same vein, the present invention goes further in this subsidiary aspect, by considering that a pre-shaped part could be made up of at least three **interconnecting** sections. Interlinking of 3D shaped sections within the middle layer prior to resin infusion is also highly innovative and hence, claims 29 to 31 each introduce additional features that are highly patentable in their own right.

7) Examiner alleges that claims 33-36 are rejected under 35 USC § 103 (a) as being unpatentable over Ross (EP0650333) as applied to claim 1 above, and further in view of Wagner (DE3837189A1).

Claims 33 to 36 are allowable by virtue of their appendance to allowable claim 1.

For the above reasons it is respectfully submitted that all pending claims are novel and inventive and therefore in condition for allowance. Favorable reconsideration is requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

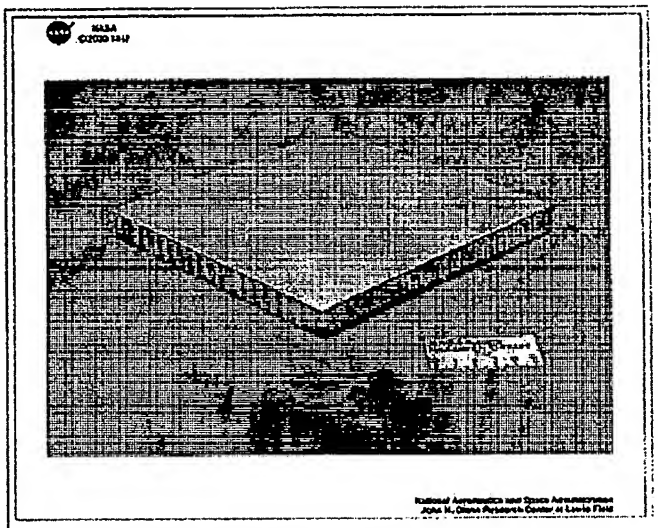
By: _____
Arthur R. Crawford
Reg. No. 25,327

ARC:eaw
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100

Sandwich structured composite

From Wikipedia, the free encyclopedia

A **sandwich structured composite** is a special class of composite materials that is fabricated by attaching two thin but stiff skins to a lightweight but thick core. The core material is normally low strength material, but its higher thickness provides the sandwich composite with high bending stiffness with overall low density.



Composite sandwich structure panel used for testing at NASA

Open and closed cell structured foam, balsa wood and syntactic foam, and composite honeycomb are commonly used core materials. Glass or carbon fiber reinforced laminates are widely used as skin materials. Sheet metal is also used as skin materials in some cases. The 1940 de Havilland Mosquito was built with sandwich composites, the balsa-wood core had on both sides plywood as the skin [1].

Recycled paper is also now being used over a closed-cell recycled kraft honeycomb core, creating a lightweight, strong and fully repulpable composite board. This material is being used for applications including point-of-purchase displays, bulkheads, recyclable office furniture, exhibition stands and wall dividers.

To fix different panels, among other solutions, are normally use a transition zone, which is a gradual reduction of the core height, until the two fiber skins are in touch. In this place, the fixation can be made by means of bolts, rivets or adhesive.

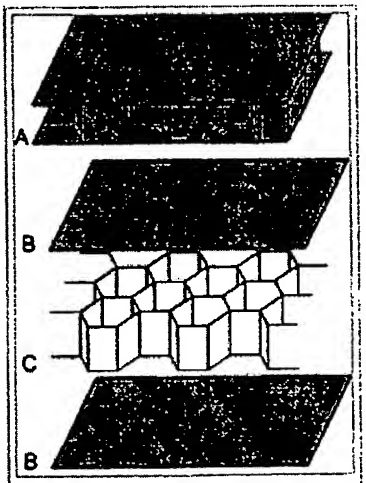


Diagram of an assembled composite sandwich (A), and its constituent face sheets or skins (B) and honeycomb core (C) (alternately: foam core)

References

1. ^ Cutler, John Henry; Koppel, Ivan; Liber, Jeremy. *Understanding Aircraft Structures*. Blackwell Publishing Limited. pp. 14. ISBN 1-4051-2032-0.

See also

- Honeycomb Structures

External links

- SandwichPanels.org (http://www.sandwichpanels.org/) – Composite sandwich structure information
- Diab Sandwich Handbook (http://www.diabgroup.com/europe/literature/e_pdf_files/man_pdf/sandwich_hb.pdf)
- Honeycomb Sandwich Design Technology (http://www.hexcel.com/NR/rdonlyres/80127A98-7DF2-4D06-A7B3-7EFF685966D2/0/7586_HexWeb_Sand_Design.pdf)

Retrieved from "http://en.wikipedia.org/wiki/Sandwich_structured_composite"
Categories: Materials stubs | Composite materials